PROTECTIVE MEASURES FOR BASECAMP LIVING QUARTERS

Michael J. Roth, P.E.*, Nicholas Boone, Pamela Kinnebrew,
Bart Durst, Toney Cummins, Thomas Slawson, PhD, P.E., Bill Heard, P.E.
US Army Corps of Engineers, Engineer Research and Development Center
Vicksburg, MS, 39180

ABSTRACT

The implementation of protective measures in basecamp living quarter areas is one of the greatest challenges currently facing the Army force protection community. These areas are heavily populated with soft-sided structures used to house soldiers and civilians. Because of the dense layout and low protection levels, they have proven to be viable targets for terrorist attack. The United States Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC), has been heavily involved with researching solutions since the onset of this problem. Included below is a summary of activities conducted in pursuit of a solution.

1. INTRODUCTION

One of the greatest force protection challenges facing US military forces in Iraq and Afghanistan is the protection of heavily populated zones within operating bases and base camps. The most notable of these at this time, is the basecamp living quarter area. Soldiers and civilians are being housed in standard trailers that are placed in exceptionally tight configurations and provide little to no protection from weapons' effects. As a result, these conditions have allowed terrorist attackers to use conventional indirect fire weapons as an effective strike tactic against these areas.

Beginning in the fall of 2003, the United States Army Corps of Engineers (USACE), Engineer Research and Development Center (ERDC), became aware of, and involved with, this problem through the USACE TeleEngineering Operations Center (TEOC). Between that time and the current date, extensive experimental work has been performed to develop a viable set of protective measures that meets the full spectrum of in-theatre forces' requirements. ERDC has coordinated with other deployed units, the USACE Protective Design Center (PDC), the US Air Force Research Laboratory (AFRL), and the Joint Security Directorate, CENTCOM. In the most recent efforts ERDC has partnered with ARCENT, the USA Counter Strike Task Force, IED Task Force, Rapid Equipping Force, Manuever Support Center, and TRADOC Futures Center to develop solutions for the Counter – Rocket, Artillery, and Mortar Initiative.

A key component, and driving factor, of any solution's feasibility is cost. To simply construct a structure capable of defeating the targeted array of weapons is only a matter of referencing the appropriate protective guidance and building a structure of sufficient mass and strength. However, the magnitude at which these measures must be employed is immense, and it is therefore impossible to employ protective measures that are based on past convention. Rather, it has become evident that a rapidly executed experimental program must be undertaken to better understand the weapons' effects and develop novel, more cost effective means of mitigating them.

Throughout the spring and summer of 2004, ERDC has been heavily involved in the conduct of experimental activities directed towards identification of a solution/solutions to this problem. Initial efforts focused on validation of a "conventional" type protective structure, which although provided the required protection, also heightened the issue of cost constraint. In response, efforts were adjusted to take a more parametric approach to the problem and individual attention was given to: 1) fragmentation effects, 2) fuze initiation, and 3) structural dynamic response. The remainder of this summary gives an overview of the initial protective design validation and the ensuing efforts in the three focus areas.

2. INITIAL DESIGN VALIDATION

Based on guidance received from forward forces, in February 2004, ERDC and PDC collaboratively developed and validated a steel protective structure. The structure was designed to be self-supportive, and would be implemented as a retrofit over the existing trailers. A full-scale prototype was constructed and validated at Fort Polk, LA. During this experiment, the structure's performance against an array of statically detonated threats (including light mortars and rockets) was validated. Upon completion, the experimental results and complete construction drawings were immediately forwarded to in-theatre forces. The validation structure is shown in Figure 1.

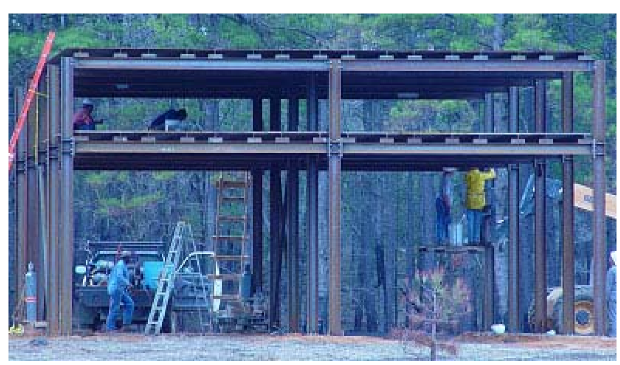

Figure 1. Full-scale prototype structure

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2. FRAGMENTATION EFFECTS

Shortly following validation of the steel protective structure, a series of arena experiments were conducted at Fort Polk to evaluate the fragment penetration resistance of various materials. Included in the experiments were soil bin walls (retrofitted and unretrofitted), concrete masonry unit walls (retrofitted and unretrofitted), ballistic armors, high performance concrete, conventional reinforced concrete and steel. As with the structure validation, an array of threat weapons was used. From the experimental results, threshold material thicknesses required to defeat the effects of each weapon were identified. This information has been included in an executive summary of experimental findings, and has been transmitted to forward forces. The information is also being used to assist in defining requirements for the other parametric evaluations. A typical arena experiment is shown in Figure 2.

Figure 2. Arena test to evaluate fragment penetration resistance

3. FUZE INITIATION

In conjunction with the arena fragmentation tests, a variety of materials were subjected to a series of live fire experiments with the same weapons to evaluate pre-detonation capabilities and fuze-membrane interaction. The live fire experiments were conducted at Fort Bliss, TX and included candidate materials such as high performance net, multiple nylon nets, metal screens, plywood, corrugated metal deck, steel mesh and different configurations of chain link fence. Threat weapons were launched in a direct fire mode at several vertical targets, each constructed with a different potential pre-detonation membrane. These weapons were also fired in an indirect mode at a large horizontal test bed. The horizontal test bed consisted of a grid of different prospective pre-detonation membranes suspended above a fragment shielding layer as determined from previous tests. Multiple impacts on the horizontal and vertical targets provided data that was compiled, analyzed and summarized in a quick look report and then forwarded to in-theater forces. Further plans are being developed for additional pre-detonation membranes to be included in a tentatively scheduled fall 2004 full-scale validation.

Figure 3. Successful fuze initiation of threat weapon

3. DYNAMIC STRUCTURAL RESPONSE

Although the target weapons' total explosive weight is relatively low, to exploit lightweight, low expense structures, an evaluation must be made of dynamic response. By doing so, structures can be put into place that provide the necessary support for optimized shielding materials while exhibiting those characteristics required to respond favorably to blast effects. Since structural configuration and dynamic response are wholly dependent on the shielding material mass and influence of the pre-detonation layer, results of the previous two studies are being used to define critical structural parameters. In fall 2004, a full-scale validation will be performed of multiple support structure configurations. The experiment will be conducted by live firing threat weapons into a structural matrix that is constructed to support validated pre-detonation and shielding materials. In this way, the interaction between the support structure and the pre-detonation/shielding layers can be evaluated, and the overall survivability level can be determined.

CONCLUSIONS

The issue of large area protection for in-theatre forces is one of the most significant problems currently facing the Army force protection community. Based on the scope of the problem and the magnitude of implemented solutions, a greater understanding of the threat and generation of new solutions is key. Over the past year, ERDC has been heavily involved in the pursuit of these solutions. The process began with the design and validation of a conventional protective structure capable of providing the required protection. But with greater knowledge of the problem, a series of parametric studies were instigated to better understand the threat and better develop viable solutions. Upon conclusion of these studies, another full-scale validation will be conducted to provide a new family of force protection solutions that – through the employment of science and technology – better address warfighter needs.

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